

Proposed Claim Amendments (09/504,923)
Appendix

In the Claims:

Claim 1 (Currently Amended): A process for producing a barrier film of a tungsten nitride by a heat CVD method which comprises the steps of:

providing a substrate on a substrate holder in a vacuum atmosphere within a CVD apparatus;

heating said substrate;

introducing a feedstock gas ~~[[slected]]~~ selected from tungsten hexafluoride gas and $W(CO)_6$ gas, a reductive nitrogen-containing gas selected from among N_2H_4 gas, NF_3 gas, N_2O gas, and NH_3 gas, a nitrogen free auxiliary reductive gas selected from among SiH_4 gas, H_2 gas, Si_2H_6 gas, PH_3 gas, and B_2H_6 gas into said vacuum atmosphere so as to form a film of the tungsten nitride on said substrate;

wherein O_2 gas is introduced into said vacuum atmosphere when forming the tungsten nitride film.

Claim 2 (Canceled)

3. (Currently Amended): A process for producing a barrier film of a tungsten nitride by the heat CVD method comprising the steps of:

providing a substrate on a substrate holder in a vacuum atmosphere within a CVD apparatus;

heating said substrate;

introducing a feedstock gas selected from among tungsten hexafluoride gas and $W(CO)_6$ gas, a reductive nitrogen-containing gas selected from among N_2H_4 gas, NF_3 gas, N_2O gas, and NH_3 gas,

a nitrogen free auxiliary reductive gas selected from among SiH_4 gas, H_2 gas, Si_2H_6 gas, PH_3 gas and B_2H_6 gas into said vacuum atmosphere so as to form a film of the tungsten nitride on said substrate, wherein said tungsten nitride film is formed by a plasma-free formation,

wherein O_2 gas is introduced into said vacuum atmosphere when forming the tungsten nitride film[[,]].

Claim 4 (Currently Amended): The process for producing a barrier film of a tungsten nitride by the heat CVD method according to claim 1, wherein said reductive nitrogen-containing gas is introduced at a flow rate once or more higher than the flow rate of said feedstock gas, and said nitrogen free auxiliary reductive gas is introduced at a flow rate once or more but not more than 10 times higher than the flow rate of said reductive nitrogen-containing gas.

Claim 5 (Currently Amended): The process for producing a barrier film of a tungsten nitride by the heat CVD method according to claim 1, wherein said reductive nitrogen-containing gas is introduced at a flow rate once or more but not more than 5 times higher than the flow rate of said feedstock gas, and said nitrogen free auxiliary reductive gas is introduced at a flow rate 2 times or more but not more than 10 times higher than the flow rate of said reductive nitrogen-containing gas.

Claim 6 (Currently Amended): The process for producing a barrier film of a tungsten nitride by the heat CVD method according to claim 1, wherein said nitrogen free auxiliary reductive gas is introduced at a flow rate once or more but not more than 15 times higher than the flow rate of the feedstock gas.

Claim 7 (Currently Amended): The process for producing a barrier film of a tungsten nitride by the heat CVD method according to claim 1, wherein the pressure of said vacuum atmosphere is regulated to 1 Pa or more but not more than 100 Pa when said tungsten nitride film is formed.

Claim 8 (Currently Amended): The process for producing a barrier film of a tungsten nitride by a heat CVD method according to claim 1, further comprising the steps of:

forming a barrier film made of a film of the tungsten nitride on a substrate on a substrate holder in a vacuum atmosphere within a CVD apparatus;

exposing the surface of said substrate to a plasma of hydrogen gas and a plasma containing at least one gas selected from among argon, nitrogen and helium gases; and then forming the film of the tungsten nitride on the surface of the substrate,

wherein the step of forming the film includes the step of heating the substrate.

Claim 9 (Withdrawn): A barrier film comprising a thin nitride film of a high temperature-melting point metal, wherein

said thin nitride film has a content of said high temperature-melting point metal exceeding the stoichiometric composition ratio thereof.

Claim 10 (Withdrawn): A barrier film comprising a thin nitride film of a high temperature-melting point metal formed on a substrate and aiming at preventing the diffusion of metals in an interconnecting thin film formed on said thin nitride film, wherein

said thin nitride film is free from silicon.

Claim 11 (Currently Amended): A process for producing a barrier film of a tungsten nitride which comprises the steps of:

providing a substrate on a substrate holder in a vacuum atmosphere within a CVD apparatus;

heating said substrate;

introducing a feedstock gas selected from tungsten hexafluoride gas and $W(CO)_6$ gas, and a NH_3 gas, and a reductive gas selected from SiH_4 gas and Si_2H_6 gas into said vacuum atmosphere so as to form a film of the tungsten nitride on said substrate,

wherein O_2 gas is introduced into said vacuum atmosphere when forming the tungsten nitride film.

Claim 12 (Cancelled)

Claim 13 (Currently Amended): The process for producing a barrier film of a tungsten nitride, comprising the steps of:

providing a substrate on a substrate holder in a vacuum atmosphere within a CVD apparatus;

heating said substrate;

introducing a feedstock gas selected from tungsten hexafluoride gas and $W(CO)_6$ gas, and a NH_3 gas, and a reductive gas selected from SiH_4 gas and Si_2H_6 gas into said vacuum atmosphere so as to form a film of the tungsten nitride on said substrate, wherein said tungsten nitride film is formed by a plasma-free formation,

wherein O_2 gas is introduced into said vacuum atmosphere when forming the tungsten nitride film.

Claim 14 (Currently Amended): The process for producing a barrier film of a tungsten nitride according to claim ~~[[12]]~~11, wherein said NH_3 gas is introduced at a flow rate once or more higher than the flow rate of said feedstock gas, and said reductive Si-containing gas is introduced at a flow rate once or more but not more than 10 times higher than the flow rate of said NH_3 gas.

Claim 15 (Currently Amended): The process for producing a barrier film of a tungsten nitride according to claim 11, wherein

said NH_3 gas is introduced at a flow rate once or more but not more than 5 times higher than the flow rate of said feedstock gas, and said reductive Si-containing gas is introduced at a flow rate 2 times or more but not more than 10 times higher than the flow rate of said NH_3 gas.

Claim 16 (Currently Amended): The process for producing a barrier film of a tungsten nitride according to claim ~~[[12]]~~11, wherein said reductive Si-containing gas is introduced at a flow rate once or more but not more than 15 times higher than the flow rate of the feedstock gas.

Claim 17 (Currently Amended): The process for producing a barrier film of a tungsten nitride according to claim 11, wherein the pressure of said vacuum atmosphere is regulated to 1 Pa or more but not more than 100 Pa when said tungsten nitride film is formed.

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